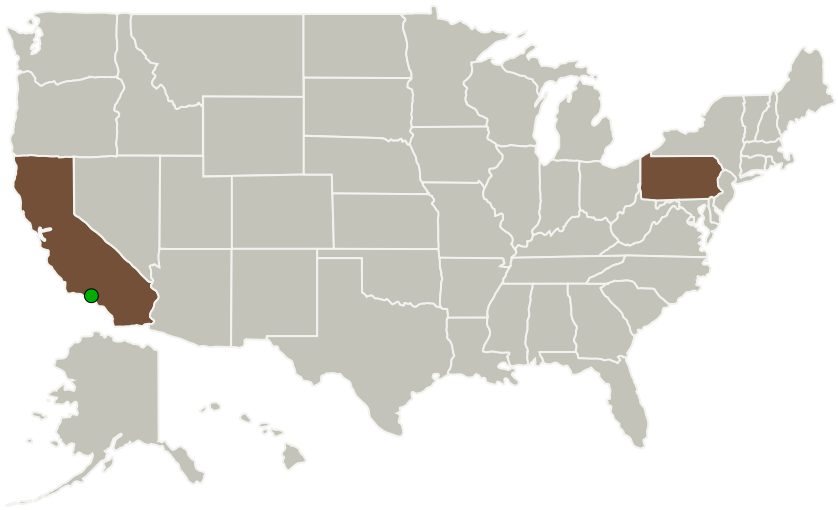
Two-phase Pumped Loop for Spacecraft Thermal Control, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

In response to NASA SBIR Topic S3.07, "Thermal Control Systems", Advanced Cooling Technologies, Inc. (ACT) proposes the development of an active Two-phase Thermal Management System (TPTMS) that relies on a single-phase liquid pump to drive two-phase flow through multiple heat sources and sinks distributed in parallel and in series while providing phase management using the momentum of the working fluid. This system is designed to address challenges discussed in the NASA Thermal Management Systems Roadmap, Technology Area (TA) 14. The use of a liquid pump to drive the system allows the working fluid to overcome large pressure drops with low power consumption. This feature, in turn, provides the ability to transfer waste heat over large distances, which is defined as a top technical challenge in TA14, Section 1.4. Additionally, flow can be driven through multiple heat exchangers or cold plates to either collect or release thermal energy. Arranged properly, this feature allows for heat load sharing, which is also defined as a top technical challenge. Added to these benefits are those intrinsic to two-phase heat transfer: near-isothermal operation, a two order of magnitude increase in the heat transferred per unit mass (TA14) and the ability to handle high heat fluxes with the appropriate heat exchanger design. Lastly, Section 2.2.3.2 of TA14 discusses the need for microgravity separators, which is an integral part of the proposed TPTMS.

Primary U.S. Work Locations and Key Partners



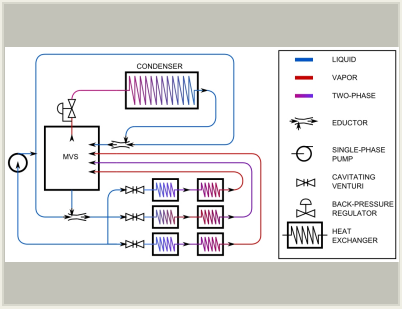


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Pennsylvania

Project Transitions

June 2015: Project Start

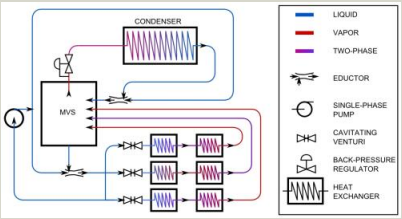
December 2015: Closed out

Closeout Summary: Two-phase Pumped Loop for Spacecraft Thermal Control, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138578)*

Images



Briefing Chart Image
Two-phase Pumped Loop for Spacecraft Thermal Control, Phase I
(https://techport.nasa.gov/image/130087)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Advanced Cooling Technologies, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Michael C Ellis

Co-Investigator:
Michael S Ellis

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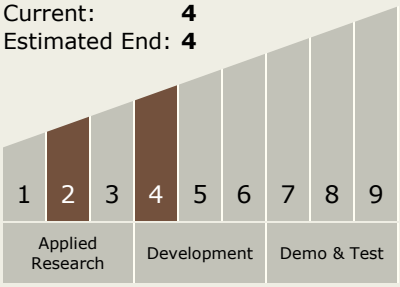
Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System